MIDDLE SCHOOL
(Grades 6-8)

MATHEMATICS
PROGRAM

RECOGNITION OF AMERICAN INDIAN CULTURE AND HERITAGE IN THE CURRICULUM PROCESS

BOARD POLICY - INSTRUCTION #2450

The MCPS Board of Trustees fully supports Article X of the Montana Constitution and is actively committed to develop for all students an understanding of American and Montana Indian people and their histories, as well as foster respect for their respective cultures.

Because of the unique position and place in American history, the American Indian peoples' role in the development of the United States, with emphasis on the experience of the Montana Tribes, shall be included wherever appropriate in the instruction of Missoula County Public School students, in accordance with the state Constitution and state standards. Instructions concerning the historic and current roles of Indian people shall be delivered in a respectful, informative, and sensitive manner. When the social studies curriculum and other curricula are updated according to the District's curriculum cycle, the written curriculum shall reflect this policy. Staff development will be provided pertinent to curriculum implementation.

NOTE: The District has nondiscriminatory policies in effect, which may be referenced.

Legal Reference:	Art. X, Sec. 1(2), Montana Constitution	
	§§ 20-1-501, et seq., MCA	Recognition of American Indian cultural heritage - legislative intent
10.55.603 ARM	Curriculum Development and Assessment	
10.55.701 ARM	Board of Trustees	
10.55.803 ARM	Learner Access	

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MONTANA OFFICE OF PUBLIC INSTRUCTION
INDIAN EDUCATION FOR ALL
MIDDLE SCHOOL LESSON PLANS

http://opi.mt.gov/Programs/IndianEd/curricsearch.html

Specific Grade Level	IEFA Math LessonTitle	URL Address
Grade 6	Making a Star Quilt	http://opi.mt.gov/PDF/IndianEd/Search/Mathematics/G%206%20Making%20Star%20Quilt.pdf
Grade 6	Stars in the Sky	http://opi.mt.gov/PDF/IndianEd/Search/Mathematics/G%206%20Stars%20in%20the%20Sky.pdf
Grade 7	Native American Designs Power Point	http://www.opi.mt.gov/pdf/IndianEd/Search/Mathematics/G%207%20Native%20American%20Designs_ppt.pdf
Grade 7	Native American Designs Lesson Plan	http://www.opi.mt.gov/pdf/IndianEd/Search/Mathematics/G%207%20Native%20American%20Designs.pdf
Grade 8	Ko'ko'hasenestotse (Cheyenne Basket Game)	http://www.opi.mt.gov/pdf/IndianEd/Search/Mathematics/G%208%20Ko'ko'hasenestotse%20(Cheyenne%20Basket%20Game).pdf
Grade 8	Surface Area and Volume Traditional Homes	http://www.opi.mt.gov/pdf/IndianEd/Search/Mathematics/G%208%20Surface%20Area%20and%20Volume%20Traditional%20Homes.pdf

HIGH SCHOOL MATHEMATICS IN MIDDLE SCHOOL

There are some students who are able to move through mathematics quickly. These students may choose to take high school mathematics beginning in eighth grade or earlier so they can take college-level mathematics in high school. Students who are capable of moving more quickly deserve thoughtful attention, both to ensure that they are challenged and that they are mastering the full range of mathematical content and skills—without omitting critical concepts and topics. Care must be taken to ensure that students master and fully understand all important topics in the mathematics curriculum, and that the continuity of the mathematics learning progression is not disrupted. In particular, the Standards for Mathematical Practice ought to continue to be emphasized in these cases.

The number of students taking high school mathematics in eighth grade has increased steadily for years. Part of this trend is the result of a concerted effort to get more students to take Calculus and other college-level mathematics courses in high school. Enrollment in both AP Statistics and AP Calculus, for example, has essentially doubled over the last decade (College Board, 2009). There is also powerful research showing that among academic factors, the strongest predictor of whether a student will earn a bachelor's degree is the highest level of mathematics taken in high school (Adelman, 1999). A recent study completed by The College Board confirms this. Using data from 65,000 students enrolled in 110 colleges, students' high school coursework was evaluated to determine which courses were closely associated with students' successful performance in college. The study confirmed the importance of a rigorous curriculum throughout a students' high school career. Among other conclusions, the study found that students who took more advanced courses, such as Pre-Calculus in the 11th grade or Calculus in 12th grade, were more successful in college. Students who took AP Calculus at any time during their high school careers were most successful (Wyatt & Wiley, 2010). And even as more students are enrolled in more demanding courses, it does not necessarily follow that there must be a corresponding decrease in engagement and success (Cooney & Bottoms, 2009, p. 2).

At the same time, there are cautionary tales of pushing underprepared students into the first course of high school mathematics in the eighth grade. The Brookings Institute's 2009 Brown Center Report on American Education found that the NAEP scores of students taking Algebra I in the eighth grade varied widely, with the bottom ten percent scoring far below grade level. And a report from the Southern Regional Education Board, which supports increasing the number of middle students taking Algebra I, found that among students in the lowest quartile on achievement tests, those enrolled in higher-level mathematics had a slightly higher failure rate than those enrolled in lower-level mathematics (Cooney & Bottoms, 2009, p. 2). In all other quartiles, students scoring similarly on achievement tests were less likely to fail if they were enrolled in more demanding courses. These two reports are reminders that, rather than skipping or rushing through content, students should have appropriate progressions of foundational content to maximize their likelihoods of success in high school mathematics.

It is also important to note that notions of what constitutes a course called "Algebra I" or "Mathematics I" vary widely. In the CCSS, students begin preparing for algebra in Kindergarten, as they start learning about the properties of operations. Furthermore, much of the content central to typical Algebra I courses—namely linear equations, inequalities, and functions—is found in the 8th grade CCSS. The Algebra I course described here ("High School Algebra I"), however, is the first formal algebra course in the Traditional Pathway (concepts from this Algebra I course are developed across the first two courses of the integrated pathway). Enrolling an eighth-grade student in a watered down version of either the Algebra I course or Mathematics I course described here may in fact do students a disservice, as mastery of algebra including attention to the Standards for Mathematical Practice is fundamental for success in further mathematics and on college entrance examinations. As mentioned above, skipping material to get students to a particular point in the curriculum will likely create gaps in the students' mathematical background, which may create additional problems later, because students may be denied the opportunity for a rigorous Algebra I or Mathematics I course and may miss important content from eighth-grade mathematics.

Middle School Acceleration

Taking the above considerations into account, as well as the recognition that there are other methods for accomplishing these goals, the Achieve Pathways Group endorses the notion that all students who are ready for rigorous high school mathematics in eighth grade should take such courses (Algebra I or Mathematics I), and that all middle schools should offer this opportunity to their students. To prepare students for high school mathematics in eighth grade, districts are encouraged to have a well-crafted sequence of compacted courses. The term "compacted" means to compress content, which requires a faster pace to complete, as opposed to skipping content. The Achieve Pathways Group has developed two compacted course sequences, one designed for districts using a traditional Algebra I – Geometry – Algebra II high school sequence, and the other for districts using an integrated sequence, which is commonly found internationally. Both are based on the idea that content should compact 3 years of content into 2 years, at most. In other words, compacting content from 2 years into 1 year would be too challenging, and compacting 4 years of content into 3 years starting in grade 7 runs the risk of compacting across middle and high schools. As such, grades 7, 8, and 9 were compacted into grades 7 and 8 (a 3:2 compaction). As a result, some 8th grade content is in the 7th grade courses, and high school content is in 8th grade.

The compacted traditional sequence, or, "Accelerated Traditional," compacts grades 7, 8, and High School Algebra I into two years: "Accelerated 7th Grade" and "8th Grade Algebra I." Upon successfully completion of this pathway, students will be ready for Geometry in high school. The compacted integrated sequence, or, "Accelerated Integrated," compacts grades 7, 8, and Mathematics I into two years: "Accelerated 7th Grade" and "8th Grade Mathematics I." At the end of 8th grade, these students will be ready for Mathematics II in high school. While the K-7 CCSS effectively prepare students for algebra in 8th grade, some standards from 8th grade have been placed in the Accelerated 7th Grade course to make the 8th Grade courses more manageable.

The Achieve Pathways Group has followed a set of guidelines7 for the development of these compacted courses.

1. Compacted courses should include the same Common Core State Standards as the non-compacted courses.
It is recommended to compact three years of material into two years, rather than compacting two years into one. The rationale is that mathematical concepts are likely to be omitted when trying to squeeze two years of material into one. This is to be avoided, as the standards have been carefully developed to define clear learning progressions through the major mathematical domains. Moreover, the compacted courses should not sacrifice attention to the Mathematical Practices Standard.

2. Decisions to accelerate students into the Common Core State Standards for high school mathematics before ninth grade should not be rushed. Placing students into tracks too early should be avoided at all costs. It is not recommended to compact the standards before grade seven. In this document, compaction begins in seventh grade for both the traditional and integrated (international) sequences.

3. Decisions to accelerate students into high school mathematics before ninth grade should be based on solid evidence of student learning. Research has shown discrepancies in the placement of students into "advanced" classes by race/ethnicity and socioeconomic background. While such decisions to accelerate are almost always a joint decision between the school and the family, serious efforts must be made to consider solid evidence of student learning in order to avoid unwittingly disadvantaging the opportunities of particular groups of students.

4. A menu of challenging options should be available for students after their third year of mathematics—and all students should be strongly encouraged to take mathematics in all years of high school. Traditionally, students taking high school mathematics in the eighth grade are expected to take Precalculus in their junior years and then Calculus in their senior years. This is a good and worthy goal, but it should not be the only option for students. Advanced courses could also include Statistics, Discrete Mathematics, or Mathematical Decision Making. An array of challenging options will keep mathematics relevant for students, and give them a new set of tools for their futures in college and career (see Fourth Courses section of this paper for further detail).

Other Ways to Accelerate Students

Just as care should be taken not to rush the decision to accelerate students, care should also be taken to provide more than one opportunity for acceleration. Some students may not have the preparation to enter a "Compacted Pathway" but may still develop an interest in taking advanced mathematics, such as AP Calculus or AP Statistics in their senior year. Additional opportunities for acceleration may include:

- Allowing students to take two mathematics courses simultaneously (such as Geometry and Algebra II, or Precalculus and Statistics).
- Allowing students in schools with block scheduling to take a mathematics course in both semesters of the same academic year.

- Offering summer courses that are designed to provide the equivalent experience of a full course in all regards, including attention to the Mathematical Practices.8
- Creating different compaction ratios, including four years of high school content into three years beginning in 9th grade.
- Creating a hybrid Algebra II-Precalculus course that allows students to go straight to Calculus.

A combination of these methods and our suggested compacted sequences would allow for the most mathematically-inclined students to take advanced mathematics courses during their high school career.

GRADE 6 MATHEMATICS

Overview:

Domains	Ratios & Proportional Relationships	The Number System	Expressions and Equations	Geometry	Statistics and Probability
Clusters	• Understand ratio concepts and use ratio reasoning to solve problems	• Apply and extend previous understandings of multiplication and division to divide fractions by fractions • Compute fluently with multi-digit numbers and find common factors and multiples • Apply and extend previous understandings of numbers to the system of rational numbers	• Apply and extend previous understandings of arithmetic to algebraic expressions • Reason about and solve one-variable equations and inequalities • Represent and analyze quantitative relationships between dependent and independent variables	• Solve real-world and mathematical problems involving area, surface area, and volume	• Develop understanding of statistical variability • Summarize and describe distributions

Mathematical Practices	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively.	3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics.	5. Use appropriate tools strategically. 6. Attend to precision.	7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

Major Thematic Grade 6 Units	English Language Arts: across the content areas • Reading • Writing • Speaking & Listening • Language • Won't Grow Up - What distinguishes childhood from adulthood? • Blasts from the Past: Greek and Roman Mythology • Courageous Characters: Bravery in the Face of Danger	Science • Earth Process/Rocks and Minerals • Weather and Climate • Investigating Local, Regional, and Global Issues (Fire on the Lang, Montana Weed Project)	Social Studies • Early Humankind and the Development of Human Societies • The Beginnings of Civilization-Mesopotamia and Egypt • Review of Map Skills • The Foundation of Western Ideas-Ancient Hebrews • West Meets East-Early Civilizations of Indian and China East Meets West-Greece and Rome

In Grade 6, instructional time should focus on four critical areas:

1. Connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems

   Students use reasoning about multiplication and division to solve ratio and rate problems about quantities. By viewing equivalent ratios and rates as deriving from, and extending, pairs of rows (or columns) in the multiplication table, and by analyzing simple drawings that indicate the relative size of quantities, students connect their understanding of multiplication and division with ratios and rates. Thus students expand the scope of problems for which they can use multiplication and division to solve problems, and they connect ratios and fractions. Students solve a wide variety of problems involving ratios and rates.

2. Completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers
   Students use the meaning of fractions, the meanings of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for dividing fractions make sense. Students use these operations to solve problems. Students extend their previous understandings of number and the ordering of numbers to the full system of rational numbers, which includes negative rational numbers, and in particular negative integers. They reason about the order and absolute value of rational numbers and about the location of points in all four quadrants of the coordinate plane.

3. Writing, interpreting, and using expressions and equations
   Students understand the use of variables in mathematical expressions. They write expressions and equations that correspond to given situations, evaluate expressions, and use expressions and formulas to solve problems. Students understand that expressions in different forms can be equivalent, and they use the properties of operations to rewrite expressions in equivalent forms. Students know that the solutions of an equation are the values of the variables that make the equation true. Students use properties of operations and the idea of maintaining the equality of both sides of an equation to solve simple one-step equations. Students construct and analyze tables, such as tables of quantities that are in equivalent ratios, and they use equations (such as $3x = y$) to describe relationships between quantities.

4. Developing understanding of statistical thinking
   Building on and reinforcing their understanding of number, students begin to develop their ability to think statistically. Students recognize that a data distribution may not have a definite center and that different ways to measure center yield different values. The median measures center in the sense that it is roughly the middle value. The mean measures center in the sense that it is the value that each data point would take on if the total of the data values were redistributed equally, and also in the sense that it is a balance point. Students recognize that a measure of variability (interquartile range or mean absolute deviation) can also be useful for summarizing data because two very different sets of data can have the same mean and median yet be distinguished by their variability. Students learn to describe and summarize numerical data sets, identifying clusters, peaks, gaps, and symmetry, considering the context in which the data were collected.

   Students in Grade 6 also build on their work with area in elementary school by reasoning about relationships among shapes to determine area, surface area, and volume. They find areas of right triangles, other triangles, and special quadrilaterals by decomposing these shapes, rearranging or removing pieces, and relating the shapes to rectangles. Using these methods, students discuss, develop, and justify formulas for areas of triangles and parallelograms. Students find areas of polygons and surface areas of prisms and pyramids by decomposing them into pieces whose area they can determine. They reason about right rectangular prisms with fractional side lengths to extend formulas for the volume of a right rectangular prism to fractional side lengths. They prepare for work on scale drawings and constructions in Grade 7 by drawing polygons in the coordinate plane.

Domain: Ratios and Proportional Relationships 6.RP

Cluster: Understand ratio concepts and use ratio reasoning to solve problems.

1. Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."*
   - I can use ratios to describe relationships between two quantities.

2. Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."*[1] (Note: Expectations for unit rates in this grade are limited to non-complex fractions.)
   - I can use unit rate in the context of a ratio relationship.

3. Use ratio and rate reasoning to solve real-world and mathematical problems from a variety of cultural contexts, including those of Montana American Indians, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
   a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
      - I can make and compare tables of equivalent ratios.
      - I can plot the pairs of values from a ratio table on a coordinate plane.
   b. Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed? As a contemporary American Indian example, it takes at least 16 hours to bead a Crow floral design on moccasins for two children. How many pairs of moccasins can be completed in 72 hours?*
      - I can solve unit rate problems.
   c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
      - I can determine a percent of a quantity.
   d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
      - I can use ratios to convert units of measurement.

Domain: The Number System 6.NS

Cluster: Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

1. Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-*

cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?

- I can compute and interpret quotients of fractions and solve word problems.

Cluster: Compute fluently with multi-digit numbers and find common factors and multiples.

2. Fluently divide multi-digit numbers using the standard algorithm.
   - I can divide multi-digit numbers.

3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
   - I can add, subtract, multiply, and divide multi-digit decimals.

4. Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express 36 + 8 as 4 (9 + 2).*
   - I can find the greatest common factor of two whole numbers less than or equal to 100.
   - I can find the least common multiple of two whole numbers less than or equal to 12.
   - I can use the distributive property.

Cluster: Apply and extend previous understandings of numbers to the system of rational numbers.

5. Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.
   - I can understand that positive and negative numbers have opposite values and apply it to real-world contexts.

6. Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.
   a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite.
   - I can use a number line to recognize that numbers with opposite signs are located on opposite sides of zero.

   b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
   - I can determine the location in quadrants of the coordinate plane based on the signs of the numbers in ordered pairs.
   - I can recognize ordered pairs with opposite signs are reflections of each other.

   c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

- I can represent integers and other rational numbers on horizontal and vertical number line diagrams and a coordinate plane.

7. Understand ordering and absolute value of rational numbers.
   a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.*
   - I can interpret inequalities using number line diagrams.

   b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write –3°C > –7°C to express the fact that –3°C is warmer than –7°C.*
   - I can write and explain real-world statements that compare rational numbers.

   c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.*
   - I can understand, interpret, and apply absolute value.

   d. Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.*
   - I can distinguish comparisons of absolute value.

8. Solve real-world and mathematical problems from a variety of cultural contexts, including those of Montana American Indians, by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.
   - I can solve real-world problems using points in all four quadrants to determine distances between points.

Domain: Expressions and Equations 6.EE

Cluster: Apply and extend previous understandings of arithmetic to algebraic expressions.

1. Write and evaluate numerical expressions involving whole-number exponents.
   - I can write and evaluate expressions with whole-number exponents.

2. Write, read, and evaluate expressions in which letters stand for numbers.
   a. Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as 5 – y.*
   - I can write expressions using variables.

   a. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression 2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.*
   - I can use mathematical terms to describe expressions.

   c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those

involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas $V = s^3$ and $A = 6 s^2$ to find the volume and surface area of a cube with sides of length $s = 1/2$.*

- I can use Order of Operations to evaluate expressions.

3. Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.*
   - I can apply properties of operations to generate equivalent expressions.

4. Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.*
   - I can identify when two expressions are equivalent.

Cluster: Reason about and solve one-variable equations and inequalities.

5. Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
   - I can understand that solving an equation or inequality can be used to answer a question.

6. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
   - I can write expressions using variables.

7. Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.
   - I can solve real-world problems by writing and solving equations using variables.

8. Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x <$ c have infinitely many solutions; represent solutions of such inequalities on number line diagrams.
   - I can write an inequality to represent a real-world situation.

Cluster: Represent and analyze quantitative relationships between dependent and independent variables.

9. Use variables to represent two quantities in a real-world problem from a variety of cultural contexts, including those of Montana American Indians, that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph

ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.

- I can write an equation that shows the relationship between an independent variable and a dependent variable.
- I can analyze the relationship between dependent and independent variables using graphs and tables.

Domain: Geometry 6.G

Cluster: Solve real-world and mathematical problems involving area, surface area, and volume.

1. Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems within cultural contexts, including those of Montana American Indians. For example, use Montana American Indian designs to decompose shapes and find the area.
   - I can find the area of polygons using the area of triangles and quadrilaterals.

2. Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\,w\,h$ and $V = b\,h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.
   - I can find the volume of a rectangular prism.

3. Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.
   - I can use coordinate points to draw polygons on a coordinate plane.
   - I can use coordinates to find the lengths of the polygon's sides.

4. Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems within cultural contexts, including those of Montana American Indians.
   - I can represent solids using nets made of rectangles and triangles.
   - I can determine the surface area of polygons using nets made of rectangles and triangles.

Domain: Statistics and Probability 6.SP

Cluster: Develop understanding of statistical variability.

1. Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.*
   - I can recognize a statistical question that anticipates variability in the data.

2. Understand that a set of data collected (including Montana American Indian demographic data) to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
   - I can describe a statistical questions distribution by its center, spread, and overall shape.

3. Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.
   - I can recognize the differences between the measures of center and the measures of variation for a numerical data set.

Cluster: Summarize and describe distributions.

4. Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
   - I can display data using dot plots (line plot), histograms, and box plots (box and whisker plot).

5. Summarize numerical data sets in relation to their context, such as by:
   a. Reporting the number of observations.
   - I can report the number of observations in a data set.
   b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
   - I can describe the attributes of a data set.
   c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
   - I can use measures of center and variability to describe patterns and deviations in a data set.
   d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.
   - I can choose which measure of center and variability best represents a data set.

Standards	Explanations and Examples
Students are expected to:	The Standards for Mathematical Practice describe ways in which students ought to engage with the subject matter as they grow in mathematical maturity and expertise.
6.MP.1. Make sense of problems and persevere in solving them.	In grade 6, students solve problems involving ratios and rates and discuss how they solved them. Students solve real world problems through the application of algebraic and geometric concepts. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?"
6.MP.2. Reason abstractly and quantitatively.	In grade 6, students represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. Students contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.
6.MP.3. Construct viable arguments and critique the reasoning of others.	In grade 6, students construct arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, and graphs, tables, and other data displays (i.e. box plots, dot plots, histograms, etc.). They further refine their mathematical communication skills through mathematical discussions in which they critically evaluate their own thinking and the thinking of other students. They pose questions like "How did you get that?", "Why is that true?" "Does that always work?" They explain their thinking to others and respond to others' thinking.
6.MP.4. Model with mathematics.	In grade 6, students model problem situations symbolically, graphically, tabularly, and contextually. Students form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. Students begin to explore covariance and represent two quantities simultaneously. Students use number lines to compare numbers and represent inequalities. They use measures of center and variability and data displays (i.e. box plots and histograms) to draw inferences about and make comparisons between data sets. Students need many opportunities to connect and explain the connections between the different representations. They should be able to use all of these representations as appropriate to a problem context.
6.MP.5. Use appropriate tools strategically.	Students consider available tools (including estimation and technology) when solving a mathematical problem and decide when certain tools might be helpful. For instance, students in grade 6 may decide to represent similar data sets using dot plots with the same scale to visually compare the center and variability of the data. Additionally, students might use physical objects or applets to construct nets and calculate the surface area of three-dimensional figures.
6.MP.6. Attend to precision.	In grade 6, students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students use appropriate terminology when referring to rates, ratios, geometric figures, data displays, and components of expressions, equations or inequalities.
6.MP.7. Look for and make use of structure.	Students routinely seek patterns or structures to model and solve problems. For instance, students recognize patterns that exist in ratio tables recognizing both the additive and multiplicative properties. Students apply properties to generate equivalent expressions (i.e. $6 + 2x = 2(3 + x)$ by distributive property) and solve equations (i.e. $2c + 3 = 15$, $2c = 12$ by subtraction property of equality; c=6 by division property of equality). Students compose and decompose two- and three-dimensional figures to solve real world problems involving area and volume.
6.MP.8. Look for and express regularity in repeated reasoning.	In grade 6, students use repeated reasoning to understand algorithms and make generalizations about patterns. During multiple opportunities to solve and model problems, they may notice that $a/b \div c/d = ad/bc$ and construct other examples and models that confirm their generalization. Students connect place value and their prior work with operations to understand algorithms to fluently divide multi-digit numbers and perform all operations with multi-digit decimals. Students informally begin to make connections between covariance, rates, and representations showing the relationships between quantities.

Standard	Grade 6 Montana Common Core Standards Vocabulary
6.RP.1	ratio
6.RP.2	ratio, rate, unit rate
6.RP.3	ratio, equivalent ratio, rate, unit rate, percent, coordinate plane
6.NS.1	quotient
6.NS.2	none
6.NS.3	none
6.NS.4	factor, multiple, GCF, LCM, distributive property
6.NS.5	positive, Negative, opposite
6.NS.6	rational number, integer, opposite, coordinate plane, ordered pair, quadrant, reflection
6.NS.7	absolute value, magnitude, rational number, positive, negative
6.NS.8	coordinate plane, quadrant, coordinates, x-coordinate, y-coordinate, absolute value
6.EE.1	base, exponent, evaluate
6.EE.2	sum, difference, term, product, factor, quotient, coefficient, arithmetic, expression, algebraic expression, substitute, evaluate
6.EE.3	equivalent expressions, commutative property, associative property, distributive property
6.EE.4	equivalent expression
6.EE.5	equation, inequality, substitute, solve, solution
6.EE.6	variable, constant, algebraic expression
6.EE.7	algebraic equation, solve
6.EE.8	inequality
6.EE.9	independent variable, dependent variable, coordinate plane
6.G.1	polygon, triangle, right triangle, quadrilateral, parallelogram, trapezoid, area, square unit
6.G.2	right rectangular prism, base, height, area, volume, cubic unit
6.G.3	vertex/vertices, coordinate, polygon
6.G.4	right rectangular prism, right triangular prism, right square pyramid, right tetrahedron, net, surface area
6.SP.1	variability
6.SP.2	distribution, center, spread, shape of data
6.SP.3	measure of center, mean, median (Q2), mode, measure of variation, range, interquartile range, extremes, lower quartile (Q1), upper quartile (Q3), outlier, mean absolute deviation
6.SP.4	line plot, dot plot, histogram, median (Q2), lower extreme, lower quartile (Q1), upper quartile (Q3), upper extreme, box plot, outlier
6.SP.5	measure of center, mean, median, mode, measure of variability, range, interquartile range, mean absolute deviation (Q2), mode, measure of variation, range, interquartile range, extremes, lower quartile (Q1), upper quartile (Q3), outlier, mean absolute deviation

GRADE 7 MATHEMATICS

Overview:

Domains	Ratios & Proportional Relationships	The Number System	Expressions and Equations	Geometry	Statistics and Probability
Clusters	• Analyze proportional relationships and use them to solve real-world and mathematical problems	• Apply and extend previous understandings of operations with fractions to add, subtract, multiply and divide rational numbers	• Use properties of operations to generate equivalent expressions • Solve real-life and mathematical problems using numerical and algebraic expressions and equations	• Draw, construct and describe geometrical figures and describe the relationships between them • Solve real-life and mathematical problems involving angle measure, area, surface and volume	• Use random sampling to draw inferences about a population • Draw informal comparative inferences about two populations • Investigate chance processes and develop, use and evaluate probability models
Mathematical Practices	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.				
Major Thematic Grade 7 Units	English Language Arts: across the content areas • Reading, • Writing • Speaking & Listening • Language • Characters with Character - What makes characters in historical fiction believable? • Perseverance - How do characters, real and fictional, use words and actions to demonstrate perseverance? • Literature Reflects Life - Is literature always a reflection of life?		Science • Cell Structure and Function • Energy and Life • Cell Reproduction and Genetics • Environmental Changes Through Time • Classification	Social Studies • Growth of Islam • African Kingdoms • Medieval China • Medieval Japan • Fall of Rome • Medieval Europe • Europe: Renaissance, Reformation, Scientific Revolution, Civilizations of the Americas	

In Grade 7, instructional time should focus on four critical areas:

1. Developing understanding of and applying proportional relationships

   Students extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.

2. Developing understanding of operations with rational numbers and working with expressions and linear equations

   Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations

of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

3. Solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume

Students continue their work with area from Grade 6, solving problems involving the area and circumference of a circle and surface area of three-dimensional objects. In preparation for work on congruence and similarity in Grade 8 they reason about relationships among two-dimensional figures using scale drawings and informal geometric constructions, and they gain familiarity with the relationships between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross-sections. They solve real-world and mathematical problems involving area, surface area, and volume of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes and right prisms.

4. Drawing inferences about populations based on samples

Students build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

Domain: Ratios and Proportional Relationships 7.RP

Cluster: Analyze proportional relationships and use them to solve real-world and mathematical problems.

1. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.*
   - I can compute unit rates when given examples in various contexts.

2. Recognize and represent proportional relationships between quantities including those represented in Montana American Indian cultural contexts.
   a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
   - I can determine if two quantities are proportional by using tables or graphs.

   b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

- I can identify and interpret the unit rate in tables, graphs, equations, diagrams, and verbal descriptions.

c. Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn. A contemporary American Indian example, analyze cost of beading materials; cost of cooking ingredients for family gatherings, community celebrations, etc.*

- I can develop equations to represent proportional relationships.

d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.

- I can determine unit rate given two coordinate points.
- I can explain what a point (x,y) on the graph of a proportional relationship means in in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.

3. Use proportional relationships to solve multi-step ratio and percent problems within cultural contexts, including those of Montana American Indians (e.g., percent of increase and decrease of tribal land). *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

- I can evaluate real world situations using multi-step ratio and percents problems within cultural contexts.

Domain: The Number System 7.NS

Cluster: Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

1. Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*

- I can select examples to demonstrate quantities that combine to make 0 (zero).

b. Understand $p + q$ as the number located a distance $|q|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.

- I can use a number line and real-world contexts to analyze the sum of two rational numbers.
- I can justify why additive inverses equal zero.

c. Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.

- I can justify, using real-world contexts, that the difference of two rational numbers is equivalent to adding the additive inverse. For example, p - q = p + (-q).
- I can show that the distance between two rational numbers on the number line is the absolute value of their differences.

d. Apply properties of operations as strategies to add and subtract rational numbers.
- I can apply properties of addition and subtraction to find sums and differences of rational numbers.

2. Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
   a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.
   - I can interpret products of rational numbers by using properties of multiplication, particularly the distributive property.

   b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.
   - I can interpret quotients of rational numbers (when the divisor is non-zero).

   c. Apply properties of operations as strategies to multiply and divide rational numbers.
   - I can apply properties of multiplication or division to find the product or quotient of rational numbers.

   d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.
   - I can convert a rational number (in a/b form) to a decimal using multiple methods.
   - I can show that the decimal form of a rational number will either terminate in 0 (zero) or eventually repeats.

3. Solve real-world and mathematical problems from a variety of cultural contexts, including those of Montana American Indians, involving the four operations with rational numbers.
   - I can decide on appropriate operations to evaluate real-world, multicultural mathematical problems involving rational numbers.

Domain: Expressions and Equations 7.EE

Cluster: Use properties of operations to generate equivalent expressions.

1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
   - I can correctly apply properties of operations in order to evaluate and expand linear expressions with positive and negative coefficients.
2. Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, $a + 0.05a = 1.05a$ means that "increase by 5%" is the same as "multiply by 1.05."*
   - I can rewrite an equation or expression to form an equivalent equation or expression in order to shed light on the problem.

Cluster: Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

3. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*
   - I can evaluate a multi-step algebraic expressions and solve equations by applying the appropriate properties of mathematics and using various tools.
   - I can solve multi-step real-life mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically.

4. Use variables to represent quantities in a real-world or mathematical problem, including those represented in Montana American Indian cultural contexts, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
   - I can construct variable equations and inequalities in order to solve multicultural real-world problems.

   a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*
      - I can evaluate equation word problems that compare algebraic solutions to arithmetic solutions and identify operations used.

   b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.*
      - I can solve and graph inequalities.
      - I can analyze the solution set of an inequality.

Domain: Geometry 7.G

Cluster: Draw construct, and describe geometrical figures and describe the relationships between them.

1. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
   - I can reproduce a geometric figure using a different scale including computing actual lengths and areas.

2. Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.
   - I can construct triangles using a variety of tools, given side and/or angle measurements.
   - I can classify unique triangles by their side and/or angle measurements, and notice when conditions determine a unique triangle, more than one triangle, or no triangle.

3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
   - I can identify the polygon that results from a plane that cuts parallel or perpendicular to the base of a solid.

Cluster: Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

4. Know the formulas for the area and circumference of a circle and use them to solve problems from a variety of cultural contexts, including those of Montana American Indians; give an informal derivation of the relationship between the circumference and area of a circle.
   - I can examine the relationship (ratio) between circumference and diameter, and apply this ratio to develop formulas for area and circumference of a circle.

5. Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.
   - I can apply understanding of "special angle pairs" to create and solve multi-step equations to find missing angle measures.

6. Solve real-world and mathematical problems from a variety of cultural contexts, including those of Montana American Indians, involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
   - I can evaluate real-world mathematical problems involving area of polygons and surface area and volume of solids.

Domain: Statistics and Probability 7.SP

Cluster: Use random sampling to draw inferences about a population.

1. Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
   - I can explain generalizations about a population from a sample.
   - I can justify that random sampling produces valid inferences about representative samples.

2. Use data, including Montana American Indian demographic data, from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled*

survey data, predict how many text messages your classmates receive in a day. Gauge how far off the estimate or prediction might be.

- I can deduce, from multiple random samples, inferences about a population and variation in estimates.

Cluster: Draw informal comparative inferences about two populations.

3. Informally assess the degree of visual overlap of two numerical data distributions with similar variability's, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.*
   - I can assess the visual overlap of two data sets with similar variables and measure the mean absolute deviation of the data (For example, make comparisons between two box and whisker plots).

4. Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.*
   - I can assess the measures of center and measures of variability from random samples to draw inferences about two populations.

Cluster: Investigate chance processes and develop, use, and evaluate probability models.

5. Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
   - I can explain the probability of an event as a number between zero and one.
   - I can evaluate if an event is likely or unlikely based on the probability written between zero and one.

6. Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times. For example, when playing Montana American Indian Hand/Stick games, you can predict the approximate number of accurate guesses.*
   - I can collect and analyze experimental probability data (especially those in a multicultural context) in order to predict future outcomes based on the relative frequency of an event.

7. Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
   a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at*

random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.

- I can create a probability model where all outcomes are equally likely.
- I can create and analyze a theoretical probability model.

b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*

- I can create an experimental probability model by observing data generated from an experiment.
- I can compare a theoretical probability model to the results of the experimental probability of that model, and explain possible sources of discrepancy.

8. Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.

- I can conclude that the probability of a compound event is the fraction of the outcome in the sample space.

b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.

- I can create tables, tree diagrams, and organized lists for compound events.
- I can identify the outcomes in the sample space.

c. Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*

- I can design a probability model to generate frequencies for compound events.

Computations with rational numbers extend the rules for manipulating fractions to complex fractions

Standards	Explanations and Examples
Students are expected to:	The Standards for Mathematical Practice describe ways in which students ought to engage with the subject matter as they grow in mathematical maturity and expertise.
7.MP.1. Make sense of problems and persevere in solving them.	In grade 7, students solve problems involving ratios and rates and discuss how they solved them. Students solve real world problems through the application of algebraic and geometric concepts. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?".
7.MP.2. Reason abstractly and quantitatively.	In grade 7, students represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. Students contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.
7.MP.3. Construct viable arguments and critique the reasoning of others.	In grade 7, students construct arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, and graphs, tables, and other data displays (i.e. box plots, dot plots, histograms, etc.). They further refine their mathematical communication skills through mathematical discussions in which they critically evaluate their own thinking and the thinking of other students. They pose questions like "How did you get that?", "Why is that true?" "Does that always work?". They explain their thinking to others and respond to others' thinking.
7.MP.4. Model with mathematics.	In grade 7, students model problem situations symbolically, graphically, tabularly, and contextually. Students form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. Students explore covariance and represent two quantities simultaneously. They use measures of center and variability and data displays (i.e. box plots and histograms) to draw inferences, make comparisons and formulate predictions. Students use experiments or simulations to generate data sets and create probability models. Students need many opportunities to connect and explain the connections between the different representations. They should be able to use all of these representations as appropriate to a problem context.
7.MP.5. Use appropriate tools strategically.	Students consider available tools (including estimation and technology) when solving a mathematical problem and decide when certain tools might be helpful. For instance, students in grade 7 may decide to represent similar data sets using dot plots with the same scale to visually compare the center and variability of the data. Students might use physical objects or applets to generate probability data and use graphing calculators or spreadsheets to manage and represent data in different forms.
7.MP.6. Attend to precision.	In grade 7, students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students define variables, specify units of measure, and label axes accurately. Students use appropriate terminology when referring to rates, ratios, probability models, geometric figures, data displays, and components of expressions, equations or inequalities.
7.MP.7. Look for and make use of structure.	Students routinely seek patterns or structures to model and solve problems. For instance, students recognize patterns that exist in ratio tables making connections between the constant of proportionality in a table with the slope of a graph. Students apply properties to generate equivalent expressions (i.e. $6 + 2x = 2\ (3 + x)$ by distributive property) and solve equations (i.e. $2c + 3 = 15$, $2c = 12$ by subtraction property of equality; c=6 by division property of equality). Students compose and decompose two- and three-dimensional figures to solve real world problems involving scale drawings, surface area, and volume. Students examine tree diagrams or systematic lists to determine the sample space for compound events and verify that they have listed all possibilities.
7.MP.8. Look for and express regularity in repeated reasoning.	In grade 7, students use repeated reasoning to understand algorithms and make generalizations about patterns. During multiple opportunities to solve and model problems, they may notice that $a/b \div c/d = ad/bc$ and construct other examples and models that confirm their generalization. They extend their thinking to include complex fractions and rational numbers. Students formally begin to make connections between covariance, rates, and representations showing the relationships between quantities. They create, explain, evaluate, and modify probability models to describe simple and compound events.

Standard	Grade 7 Montana Common Core Standards Vocabulary
7.RP.1	ratio, rate, unit rate
7.RP.2	proportional relationship, constant of proportionality, unit rate, equivalent ratios, origin
7.RP.3	proportional relationship, ratio, percent
7.NS.1	Positive, negative, opposite, additive inverse, absolute value, integer, rational number
7.NS.2	integer, rational number, terminating decimal, repeating decimal
7.NS.3	rational number, complex fraction
7.EE.1	linear expression, coefficient, like terms
7.EE.2	none
7.EE.3	rational number
7.EE.4	none
7.G.1	scale drawing
7.G.2	none
7.G.3	right rectangular prism, right rectangular pyramid
7.G.4	radius, diameter, circumference, area, pi
7.G.5	supplementary angles, complementary angles, vertical angles, adjacent angles
7.G.6	length, width, base, height, altitude, area, surface area, volume
7.SP.1	sample, population, random sample, representative sample
7.SP.2	population, sample, random sample
7.SP.3	centers (also, measures of center), variabilities (also, measures of variability), mean, median, mean absolute deviation, interquartile range
7.SP.4	measures of variability, measures of center, mean, median, mean, absolute deviation, interquartile range, population, random sample
7.SP.5	likely, unlikely
7.SP.6	theoretical probability, experimental probability, relative frequency
7.SP.7	probability model, uniform probability model, frequency, relative frequency, theoretical probability, experimental probability
7.SP.8	compound events, sample space, tree diagram, outcomes, favorable outcomes, simulation

GRADE 7 MATHEMATICS - ACCELERATED

Overview:

Domains	Ratios & Proportional Relationships	The Number System	Expressions and Equations	Geometry	Statistics and Probability
Clusters	• Analyze proportional relationships and use them to solve real-world and mathematical problems	• Apply and extend previous understandings of operations with fractions to add, subtract, multiply and divide rational numbers	• Use properties of operations to generate equivalent expressions • Solve real-life and mathematical problems using numerical and algebraic expressions and equations	• Draw, construct and describe geometrical figures and describe the relationships between them • Solve real-life and mathematical problems involving angle measure, area, surface and volume	• Use random sampling to draw inferences about a population • Draw informal comparative inferences about two populations • Investigate chance processes and develop, use and evaluate probability models

Mathematical Practices	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively.	3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics.	5. Use appropriate tools strategically. 6. Attend to precision.	7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

Major Thematic Grade 7 Units	English Language Arts: across the content areas • Reading • Writing • Speaking & Listening • Language • Characters with Character - What makes characters in historical fiction believable? • Perseverance - How do characters, real and fictional, use words and actions to demonstrate perseverance? • Literature Reflects Life - Is literature always a reflection of life?	Science • Cell Structure and Function • Energy and Life • Cell Reproduction and Genetics • Environmental Changes Through Time • Classification	Social Studies • Growth of Islam • African Kingdoms • Medieval China • Medieval Japan • Fall of Rome • Medieval Europe • Europe: Renaissance, Reformation, Scientific Revolution, Civilizations of the Americas

This course differs from the non-accelerated 7th Grade course in that it contains content from 8th grade. While coherence is retained, in that it logically builds from the 6th Grade, the additional content when compared to the non-accelerated course demands a faster pace for instruction and learning. Content is organized into four critical areas, or units. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

The critical areas are as follows:

Critical Area 1: Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships

between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative
numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems. They extend their mastery of the properties of operations to develop an understanding of integer exponents, and to work with numbers written in scientific notation.

Critical Area 2: Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ($y/x = m$ or $y = mx$) as special linear equations ($y = mx + b$), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount $m \times A$. Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the
properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation.

Critical Area 3: Students build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

Critical Area 4: Students continue their work with area from Grade 6, solving problems involving the area and circumference of a circle and surface area of three-dimensional objects. In preparation for work on congruence and similarity, they reason about relationships among two-dimensional figures using scale drawings and informal geometric constructions, and they gain familiarity with the relationships between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross sections. They solve real-world and mathematical problems involving area, surface area, and volume of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes and right prisms. Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

Domain: Ratios and Proportional Relationships 7.RP

Cluster: Analyze proportional relationships and use them to solve real-world and mathematical problems.

- Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in*

each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.

- I can compute unit rates.

2. Recognize and represent proportional relationships between quantities including those represented in Montana American Indian cultural contexts.
   a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
   - I can determine if two quantities are proportional by using tables or graphs.

   b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
   - I can interpret the unit rate in tables, graphs, equations, diagrams, and verbal descriptions.

   c. Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn. A contemporary American Indian example, analyze cost of beading materials; cost of cooking ingredients for family gatherings, community celebrations, etc.*
   - I can develop equations to represent proportional relationships.

   d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.
   - I can determine unit rate given two coordinate points.

3. Use proportional relationships to solve multistep ratio and percent problems within cultural contexts, including those of Montana American Indians (e.g., percent of increase and decrease of tribal land). *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*
   - I can evaluate real world situations using proportions.

Domain: The Number System 7.NS

Cluster: Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

1. Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
   a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.*
   - I can describe situations in which the additive inverse has been used.

   b. Understand $p + q$ as the number located a distance $|q|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
   - I can analyze, through real-world contexts, the sum of two rational numbers.
   - I can justify why additive inverses equal zero.

c. Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
- I can evaluate and apply, using real-world contexts, the difference of two rational numbers. For example, p-q = p+-q.

d. Apply properties of operations as strategies to add and subtract rational numbers.
- I can select and justify properties of addition and subtraction to find sums and differences of rational numbers.

2. Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
   a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.
   - I can interpret products of rational numbers by using properties of multiplication, particularly the distributive property.

   b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.
   - I can interpret quotients of rational numbers (when the divisor is non-zero).

   c. Apply properties of operations as strategies to multiply and divide rational numbers.
   - I can select and justify properties of multiplication and division to find the product and quotient of rational numbers.

   d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.
   - I can convert a rational number (in a/b form) to a decimal using multiple methods.

3. Solve real-world and mathematical problems from a variety of cultural contexts, including those of Montana American Indians, involving the four operations with rational numbers.
   a. I can choose appropriate operations to evaluate real-world mathematical problems involving rational numbers.

Domain: The Number System 8.NS.

Cluster: Know that there are numbers that are not rational, and approximate them by rational numbers.

1. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
   - I can demonstrate that every number has a decimal expansion.
   - I can convert a rational number (a/b) into appropriate decimal notation.
   - I can convert a repeating decimal number into simplified rational form.

2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., $\pi 2$). *For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*
   - I can use the appropriate estimates of irrational numbers to compare, order on a number line, and find approximate values of variable expressions.

Domain: Expressions and Equations 7.EE

Cluster: Use properties of operations to generate equivalent expressions.

1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
   - I can correctly apply properties of operations in order to evaluate and expand linear expressions with coefficients.

2. Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, $a + 0.05a = 1.05a$ means that "increase by 5%" is the same as "multiply by 1.05."*
   - I can rewrite an equation or expression to form an equivalent equation or expression.

Cluster: Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

3. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*
   - I can evaluate multi-step algebraic expressions and equations using various tools.

4. Use variables to represent quantities in a real-world or mathematical problem, including those represented in Montana American Indian cultural contexts, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
   - I can construct variable equations and inequalities in order to solve multicultural real-world problems.

   a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*
      - I can evaluate word problems with equations that compare algebraic solutions to arithmetic solutions identifying operations used.

   b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it

in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.*

- I can solve and graph inequalities.
- I can analyze the solution set of an inequality.

Domain: Expressions and Equations 8.EE

Cluster: Work with radicals and integer exponents.

1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $32 \times 3^{-5} = 3^{-3} = 1/33 = 1/27$.
   - I can apply the properties of integer exponents to generate equivalent expressions.
2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
   - I can express the solution to a square root or cube root problem in radical form.
   - I can evaluate the roots of small perfect squares and cubes.
   - I can predict when a small perfect square or cube root is rational or irrational.

3. Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger.*
   - I can use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or small quantities.
   - I can state how many times larger or smaller items are when quantities are in the form of a single digit times an integer power of 10.

4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.
   - I can perform operations in scientific notation, decimal notation, or a combination of both scientific and decimal notation.
   - I can write measurements of very large and very small quantities in scientific notation and choose units of appropriate size for the given situation.
   - I can interpret the different formats of scientific notation that have been generated by technology.

Cluster: Understand the connections between proportional relationships, lines, and linear equations.

5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

- I can graph proportional relationships identifying the unit rate as the slope of the graph.
- I can compare two different proportional relationships represented in different ways and state the connections between them.

6. Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at *b*.
   - I can use similar triangles to explain why the slope "m" is the same between any two distinct points on a non-vertical line in the coordinate plane.
   - I can derive the equation y = m* x (+0) for a line through the origin.
   - I can derive the equation y = m* x + b for a line intercepting the vertical axis at b and cannot equal 0.

Cluster: Analyze and solve linear equations and pairs of simultaneous linear equations.

7. Solve linear equations in one variable.
   a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where *a* and *b* are different numbers).
   - I can solve multi-step linear equations in one variable.
   - I can solve linear equations with the same variable on both sides of the equal sign.

   b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
   - I can solve multi-step linear equations in one variable that include rational number coefficients, distributive property, and collecting like terms.

8. Analyze and solve pairs of simultaneous linear equations.
   a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
   - I can graph two linear equations on the same coordinate plane and identify their point of intersection if possible.
   - I can defend that the point of intersection of two lines on the same coordinate plane is a solution for both equations.

   b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.*
   - I can rewrite an equation into slope-intercept form.
   - I can solve a system of two linear equations algebraically.
   - I can estimate the solution of a system of linear equations by graphing.

   c. Solve real-world and mathematical problems from a variety of cultural contexts, including those of Montana American Indians, leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*
   - I can solve real-world mathematical problems from a variety of cultures which involve systems of linear equations.

Domain: Geometry *7.G*

Cluster: Draw construct, and describe geometrical figures and describe the relationships between them.

1. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
   - I can reproduce a geometric figure using a different scale.
   - I can compute actual lengths and areas from a scale drawing.

2. Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.
   - I can construct triangles using a variety of tools, given side and/or angle measurements.
   - I can classify unique triangles by their side and/or angle measurements. For example, isosceles, equilateral, scalene, obtuse, right, or acute.

3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
   - I can identify the polygon that results from a plane that cuts parallel or perpendicular to the base of a solid.

Domain: Geometry 8.G

Cluster: Understand congruence and similarity using physical models, transparencies, or geometry software.

1. Verify experimentally the properties of rotations, reflections, and translations from a variety of cultural contexts, including those of Montana American Indians:
   a. Lines are taken to lines, and line segments to line segments of the same length.
   b. Angles are taken to angles of the same measure.
   c. Parallel lines are taken to parallel lines.
   - I can create and characterize reflections, rotations, and translations using a variety of tools.

2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
   - I can define congruency in two-dimensional figures giving examples and non-examples.
   - I can describe the sequence of transformations between two congruent figures.

3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures from a variety of cultural contexts, including those of Montana American Indians: using coordinates.
   - I can describe the effect of transformations observed in Native American geometric patterns using coordinate notation.

4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
   - I can define similarity in two-dimensional figures giving examples and non-examples.

- I can describe the sequence of transformations between two similar figures.

5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*
   - I can demonstrate the sum of interior angles of any triangle is equal to 180 degrees.
   - I can generalize the patterns and relationships found between the interior and exterior angles of any triangle.
   - I can summarize the patterns and relationships found among the angle created when parallel lines are cut by a transversal.
   - I can justify similarity between triangles using angle to angle correspondence.

Cluster: Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
   - I can apply the formulas for the volumes of cones, cylinders, and spheres to solve real-world mathematical problems.

Domain: Statistics and Probability 7.SP

Cluster: Use random sampling to draw inferences about a population.

1. Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
   - I can explain generalizations about a population from a sample.
   - I can justify that random sampling produces valid inferences about representative samples.

2. Use data, including Montana American Indian demographic data, from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data, predict how many text messages your classmates receive in a day. Gauge how far off the estimate or prediction might be.*
   - I can deduce, from random samples, inferences about a population and compose multiple samples to draw conclusions.

Cluster: Draw informal comparative inferences about two populations.

3. Informally assess the degree of visual overlap of two numerical data distributions with similar variability's, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability*

(mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.

- I can assess the overlap of two data sets with similar variables and measure the mean absolute deviation of the data.

4. Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.*
   - I can assess the measures of center and measures of variability from random samples to draw inferences about two populations.

Cluster: Investigate chance processes and develop, use, and evaluate probability models.

5. Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
   - I can explain the probability of an event as a number between zero and one.
   - I can evaluate if an event is likely or unlikely based on the probability written between zero and one.

6. Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times. For example, when playing Montana American Indian Hand/Stick games, you can predict the approximate number of accurate guesses.*
   - I can analyze experimental probability data in order to predict future outcomes based on the relative frequency of an event.

7. Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
   - I can create and analyze a theoretical probability model.
   - I can compare theoretical probability model to the results of the experimental probability of that model.

   a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.*
      - I can create a probability model where all outcomes are equally likely.

   b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*

- I can create an experimental probability model to observe data generated from an experiment.

8. Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
   a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
   - I can conclude that the probability of a compound event is a fraction of the outcome in the sample space.

   b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.
   - I can create tables, tree diagrams, and organized lists for compound events.
   - I can identify the outcomes in the sample space.
   c. Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*
   - I can design a probability model to generate frequencies for compound events.

Computations with rational numbers extend the rules for manipulating fractions to complex fractions.

Standards	Explanations and Examples
Students are expected to:	The Standards for Mathematical Practice describe ways in which students ought to engage with the subject matter as they grow in mathematical maturity and expertise.
7.MP.1. Make sense of problems and persevere in solving them.	In grade 7, students solve problems involving ratios and rates and discuss how they solved them. Students solve real world problems through the application of algebraic and geometric concepts. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?".
7.MP.2. Reason abstractly and quantitatively.	In grade 7, students represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. Students contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.
7.MP.3. Construct viable arguments and critique the reasoning of others.	In grade 7, students construct arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, and graphs, tables, and other data displays (i.e. box plots, dot plots, histograms, etc.). They further refine their mathematical communication skills through mathematical discussions in which they critically evaluate their own thinking and the thinking of other students. They pose questions like "How did you get that?", "Why is that true?" "Does that always work?". They explain their thinking to others and respond to others' thinking.
7.MP.4. Model with mathematics.	In grade 7, students model problem situations symbolically, graphically, tabularly, and contextually. Students form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. Students explore covariance and represent two quantities simultaneously. They use measures of center and variability and data displays (i.e. box plots and histograms) to draw inferences, make comparisons and formulate predictions. Students use experiments or simulations to generate data sets and create probability models. Students need many opportunities to connect and explain the connections between the different representations. They should be able to use all of these representations as appropriate to a problem context.

7.MP.5. Use appropriate tools strategically.	Students consider available tools (including estimation and technology) when solving a mathematical problem and decide when certain tools might be helpful. For instance, students in grade 7 may decide to represent similar data sets using dot plots with the same scale to visually compare the center and variability of the data. Students might use physical objects or applets to generate probability data and use graphing calculators or spreadsheets to manage and represent data in different forms.
7.MP.6. Attend to precision.	In grade 7, students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students define variables, specify units of measure, and label axes accurately. Students use appropriate terminology when referring to rates, ratios, probability models, geometric figures, data displays, and components of expressions, equations or inequalities.
7.MP.7. Look for and make use of structure.	Students routinely seek patterns or structures to model and solve problems. For instance, students recognize patterns that exist in ratio tables making connections between the constant of proportionality in a table with the slope of a graph. Students apply properties to generate equivalent expressions (i.e. $6 + 2x = 2(3 + x)$ by distributive property) and solve equations (i.e. $2c + 3 = 15$, $2c = 12$ by subtraction property of equality; c=6 by division property of equality). Students compose and decompose two- and three-dimensional figures to solve real world problems involving scale drawings, surface area, and volume. Students examine tree diagrams or systematic lists to determine the sample space for compound events and verify that they have listed all possibilities.
7.MP.8. Look for and express regularity in repeated reasoning.	In grade 7, students use repeated reasoning to understand algorithms and make generalizations about patterns. During multiple opportunities to solve and model problems, they may notice that $a/b \div c/d = ad/bc$ and construct other examples and models that confirm their generalization. They extend their thinking to include complex fractions and rational numbers. Students formally begin to make connections between covariance, rates, and representations showing the relationships between quantities. They create, explain, evaluate, and modify probability models to describe simple and compound events.

Standard	Grade 7 Accelerated Montana Common Core Standards Vocabulary
7.RP.1	ratio, rate, unit rate
7.RP.2	proportional relationship, constant of proportionality, unit rate, equivalent ratios, origin
7.RP.3	proportional relationship, ratio, percent
7.NS.1	Positive, negative, opposite, additive inverse, absolute value, integer, rational number
7.NS.2	integer, rational number, terminating decimal, repeating decimal
7.NS.3	rational number, complex fraction
7.EE.1	linear expression, coefficient, like terms
7.EE.2	none
7.EE.3	rational number
7.EE.4	none
7.G.1	scale drawing
7.G.2	none
7.G.3	right rectangular prism, right rectangular pyramid
7.G.4	radius, diameter, circumference, area, pi
7.G.5	supplementary angles, complementary angles, vertical angles, adjacent angles
7.G.6	length, width, base, height, altitude, area, surface area, volume
7.SP.1	sample, population, random sample, representative sample
7.SP.2	population, sample, random sample
7.SP.3	centers (also, measures of center), variabilities (also, measures of variability), mean, median, mean absolute deviation, interquartile range
7.SP.4	measures of variability, measures of center, mean, median, mean, absolute deviation, interquartile range, population, random sample
7.SP.5	likely, unlikely
7.SP.6	theoretical probability, experimental probability, relative frequency
7.SP.7	probability model, uniform probability model, frequency, relative frequency, theoretical probability, experimental probability
7.SP.8	compound events, sample space, tree diagram, outcomes, favorable outcomes, simulation

GRADE 8 MATHEMATICS

Overview:

Domains	The Number System	Expressions and Equations	Functions	Geometry	Statistics & Probability
Clusters	• Know that there are numbers that are not rational, and approximate them by rational numbers	• Work with radicals and integer exponents • Understand the connections between proportional relationships, lines, and linear equations • Analyze and solve linear equations and pairs of simultaneous linear equations	• Define, evaluate, and compare functions • Use functions to model relationships between quantities	• Understand congruence and similarity using physical models, transparencies, or geometry software • Understand and apply the Pythagorean Theorem • Solve real-world and mathematical problems involving volume of cylinders, cones and spheres	• Investigate patterns of association in bivariate data
Mathematical Practices	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively.	3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics.	5. Use appropriate tools strategically. 6. Attend to precision.	7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	
Major Thematic Grade 8 Units	English Language Arts: across the content areas • Reading • Writing • Speaking & Listening • Language • Figure it Out: Mysteries – What makes us want to read? • Science or Fiction – How do we determine where the line should be drawn between what we consider as fiction and what we explore as science? Does fiction fuel science or does science drive the writing of fiction? • The Road Not Taken: Going Against Conventional Wisdom – Does society always provide us with the best advice? How do we learn what to value and what choices to make? Can literature help us define the greater good?	Science • Structure of Matter • Properties of Matter • Basics of Energy • Forms of Energy • Forces and Motion • Simple Machines	Social Studies • Indigenous Cultures • Colonial Heritage • Events to the American Revolution • War for Independence • Constitution • New Nation • Age of Andrew Jackson • Regional Development • Industrial Beginnings • Pre-Civil War – Reconstruction		

In Grade 8, instructional time should focus on three critical areas:

1. Formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations

   Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ($y/x = m$ or $y = mx$) as special linear equations ($y = mx + b$), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount $m \cdot A$. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to

express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and *y*-intercept) in terms of the situation.

Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

2. Grasping the concept of a function and using functions to describe quantitative relationships

Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

3. Analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem

Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

Domain: The Number System 8.NS

Cluster: Know that there are numbers that are not rational, and approximate them by rational numbers.

1. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
   - I can demonstrate that every number has a decimal expansion.
   - I can convert a rational number (a/b) into appropriate decimal notation.
   - I can convert a repeating decimal number into simplified rational form.

2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*

- I can use the appropriate estimates of irrational numbers to compare, order on a number line, and find approximate values of variable expressions.

Domain: Expressions and Equations 8.EE

Cluster: Work with radicals and integer exponents.

1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.
   - I can apply the properties of integer exponents to generate equivalent expressions.

2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
   - I can express the solution to a square root or cube root problem in radical form.
   - I can evaluate the roots of small perfect squares and cubes.
   - I can predict when a square or cube root is rational or irrational.

3. Use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger.*
   - I can use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or small quantities.
   - I can state how many times larger or smaller items are when quantities are in the form of a single digit times an integer power of 10.

4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.
   - I can perform operations in scientific notation, decimal notation, or a combination of both scientific and decimal notation.
   - I can write measurements of very large and very small quantities in scientific notation and choose units of appropriate size for the given situation.
   - I can interpret the different formats of scientific notation that have been generated by technology.

Cluster: Understand the connections between proportional relationships, lines, and linear equations.

5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
   - I can graph proportional relationships identifying the unit rate as the slope of the graph.

- I can compare two different proportional relationships represented in different ways and state the connections between them.

6. Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at *b*.
   - I can use similar triangles to explain why the slope "m" is the same between any two distinct points on a non-vertical line in the coordinate plane.
   - I can derive the equation y = m* x (+0) for a line through the origin.
   - I can derive the equation y = m* x + b for a line intercepting the vertical axis at b and cannot equal 0.

Cluster: Analyze and solve linear equations and pairs of simultaneous linear equations.

7. Solve linear equations in one variable.
   a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where *a* and *b* are different numbers).
      - I can solve multi-step linear equations in one variable.
      - I can solve linear equations with the same variable on both sides of the equal sign.
   b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
      - I can solve multi-step linear equations in one variable that include rational number coefficients, distributive property, and collecting like terms.

8. Analyze and solve pairs of simultaneous linear equations.
   a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
      - I can graph two linear equations on the same coordinate plane and identify their point of intersection if possible.
      - I can verify and defend that the point of intersection of two lines on the same coordinate plane is a solution for both equations.
   b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.*
      - I can rewrite an equation from standard form into slope-intercept form.
      - I can solve a system of two linear equations algebraically.
      - I can estimate the solution of a system of linear equations by graphing.
   c. Solve real-world and mathematical problems from a variety of cultural contexts, including those of Montana American Indians, leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*
      - I can solve real-world mathematical problems from a variety of cultures which involve systems of linear equations.

Domain: Functions 8.F

Cluster: Define, evaluate, and compare functions.

1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.[1]
   ([1]Function notation is not required in Grade 8.)
   - I can define a function as a rule for ordered pairs that shows each input has exactly one output.
   - I can relate input to output in graphical form as ordered pairs.

2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*
   - I can create a function table.
   - I can graph the contents of a function table.
   - I can write a function rule in y = m * x + b form from multiple sources.
   - I can compare and analyze two functions represented in different forms.

3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*
   - I can identify the attributes of linear or non-linear functions based on multiple sources.

Cluster: Use functions to model relationships between quantities.

4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
   - I can determine the rate of change and initial value from a table, a graph, an equation, and a verbal model.
   - I can write a function rule (y = m * x + b) from any of the other three representations.

5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
   - I can write a verbal model of a graph showing a functional relationship.
   - I can produce an approximate graph of a functional relationship from a verbal model.

Domain: Geometry 8.G

Cluster: Understand congruence and similarity using physical models, transparencies, or geometry software.

1. Verify experimentally the properties of rotations, reflections, and translations from a variety of cultural contexts, including those of Montana American Indians:
   a. Lines are taken to lines, and line segments to line segments of the same length.

b. Angles are taken to angles of the same measure.
c. Parallel lines are taken to parallel lines.
- I can create and characterize reflections, rotations, and translations using a variety of tools.

2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
   - I can define congruency in two-dimensional figures giving examples and non-examples.
   - I can describe the sequence of transformations between two congruent figures.
3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures from a variety of cultural contexts, including those of Montana American Indians: using coordinates.
   - I can describe the effect of transformations observed in Native American geometric patterns using coordinate notation.

4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
   - I can define similarity in two-dimensional figures giving examples and non-examples.
   - I can describe the sequence of transformations between two similar figures.

5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*
   - I can demonstrate the sum of interior angles of any triangle is equal to 180 degrees.
   - I can generalize the patterns and relationships found between the interior and exterior angles of any triangle.
   - I can summarize the patterns and relationships found among the angles created when parallel lines are cut by a transversal.
   - I can justify similarity between triangles using angle to angle correspondence.

Cluster: Understand and apply the Pythagorean Theorem.

6. Explain a proof of the Pythagorean Theorem and its converse.
   - I can explain and prove the Pythagorean Theorem and its converse.

7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. *For example, determine the unknown height of a Plains Indian tipi when given the side length and radius.*
   - I can apply the Pythagorean Theorem to determine unknown side lengths in 2D and 3D real world situations.

8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
    - I can apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Cluster: Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
    - I can apply the formulas for the volumes of cones, cylinders, and spheres to solve real-world mathematical problems.

Domain: Statistics and Probability 8.SP

Cluster: Investigate patterns of association in bivariate data.

1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
    - I can define and create examples of clustering, outliers, positive or negative association, linear association, and nonlinear association.
    - I can construct and interpret scatter plots to investigate patterns of association.

2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
    - I can sketch a line of best fit for a graph of bivariate data.(scatter plot)
    - I can construct and interpret scatter plots to investigate patterns of association.
    - I can use the closeness of the data points to the line of best fit to assess the correlation between the predicted values and the actual data.

3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*
    - I can interpret the slope and intercept of a line of best fit in the context of the bivariate data set.

4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data including data from Montana American Indian sources on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*
    - I can construct a two-way frequency table from a variety of cultural contexts, including data from Montana American Indian sources.

- I can interpret relative frequencies calculated for rows or columns to describe possible associations between the two variables.

Standards	Explanations and Examples
Students are expected to:	The Standards for Mathematical Practice describe ways in which students ought to engage with the subject matter as they grow in mathematical maturity and expertise.
8.MP.1. Make sense of problems and persevere in solving them.	In grade 8, students solve real world problems through the application of algebraic and geometric concepts. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?"
8.MP.2. Reason abstractly and quantitatively.	In grade 8, students represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. They examine patterns in data and assess the degree of linearity of functions. Students contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.
8.MP.3. Construct viable arguments and critique the reasoning of others.	In grade 8, students construct arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, and graphs, tables, and other data displays (i.e. box plots, dot plots, histograms, etc.). They further refine their mathematical communication skills through mathematical discussions in which they critically evaluate their own thinking and the thinking of other students. They pose questions like "How did you get that?", "Why is that true?" "Does that always work?" They explain their thinking to others and respond to others' thinking.
8.MP.4. Model with mathematics.	In grade 8, students model problem situations symbolically, graphically, tabularly, and contextually. Students form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. Students solve systems of linear equations and compare properties of functions provided in different forms. Students use scatterplots to represent data and describe associations between variables. Students need many opportunities to connect and explain the connections between the different representations. They should be able to use all of these representations as appropriate to a problem context.
8.MP.5. Use appropriate tools strategically.	Students consider available tools (including estimation and technology) when solving a mathematical problem and decide when certain tools might be helpful. For instance, students in grade 8 may translate a set of data given in tabular form to a graphical representation to compare it to another data set. Students might draw pictures, use applets, or write equations to show the relationships between the angles created by a transversal.
8.MP.6. Attend to precision.	In grade 8, students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students use appropriate terminology when referring to the number system, functions, geometric figures, and data displays.
8.MP.7. Look for and make use of structure.	Students routinely seek patterns or structures to model and solve problems. In grade 8, students apply properties to generate equivalent expressions and solve equations. Students examine patterns in tables and graphs to generate equations and describe relationships. Additionally, students experimentally verify the effects of transformations and describe them in terms of congruence and similarity.
8.MP.8. Look for and express regularity in repeated reasoning.	In grade 8, students use repeated reasoning to understand algorithms and make generalizations about patterns. Students use iterative processes to determine more precise rational approximations for irrational numbers. During multiple opportunities to solve and model problems, they notice that the slope of a line and rate of change are the same value. Students flexibly make connections between covariance, rates, and representations showing the relationships between quantities.

Grade 8 Montana Common Core Vocabulary									
Standard	Vocabulary	Standard	Vocabulary	Standard	Vocabulary	Standard	Vocabulary	Standard	Vocabulary
S.ID.2	absolute deviation	A.REI.3	equation	8.G.6	leg	8.G.6	Pythagorean Theorem	A.CED.3	union
F.IF.7	absolute value	A.CED.4	equivalent equation	A.REI.3	like terms	F.LE.1	quadratic equation	F.LE.1	unit rate
F.IF.7	absolute value equation	A.CED.4	equivalent expression	8.SP.2	line of best fit/trend line	A.CED.1	quadratic formula	8.SP.4	univariate
F.IF.7	absolute value function	A.REI.5	equivalent inequalities	A.REI.3	linear	F.LE.1	quadratic function	A.CED.3	universal set
A.RIE.3	additive identity	F.LE.1	exponent	8.SP.1	linear association	A.REI.2	radical	A.CED.1	variable
A.REI.3	additive inverse	A.CED.1	exponential	A.CED.1	linear equation	A.REI.2	radical expression	F.LE.1	vertex
F.LE.2	arithmetic sequence	F.IF.8	exponential decay	A.CED.2	linear function	A.REI.2	radical function	F.LE.1	vertex form of a quadratic equation
F.IF.7	axis of symmetry	F.LE.1	exponential function	A.CED.1	linear inequality	A.REI.2	radical symbol	F.LE.3	vertical motion model
A.CED.1	base	F.IF.8	exponential growth	F.IF.7	linear model	F.IF.1	range	A.REI.1	x and y intercepts
A.REI.4	binomial	A.SSE.1	expression	F.IF.8	linear regression	F.IF.6	rate	A.SSE.3	zero exponent
8.SP. 4	bivariate	A.REI.2	extraneous solution	F.IF.7	linear representation	F.IF.6	rate of change	A.SSE.3	zeros of a function
S.ID.1	box and whisker plot	F.BF.1	extrapolation	A.CED.4	literal equation	F.IF.6	ratio		
S.ID.9	causation	S.ID.3	extreme value	A.SSE.3	maximum value/maxima	N.RN.1	rational equation		
A.REI.2	closed system	A.SSE.1	factor	S.ID.3	measures of central tendency	N.RN.1	rational number		
8.SP.1	clustering	A.SSE.3	factor completely	A.SSE.3	minimum value/minima	N.RN.3	real number		
A.SSE.1	coefficient	A.REI.4	factoring	A.APR.1	monomial	A.REI.3	reciprocal		
A.REI.4	completing the square	F.IF.8	family of function	A.REI.3	multiplicative identity	F.BF.1	recursive		
A.CED.3	compound inequality	S.ID.5	frequency	A.REI.3	multiplicative inverse	A.CED.1	relation		
A.REI.4	compound interest	A.CED.1	function	8.SP.1	negative association/correlation	A.REI.2	restricted domain		
A.REI.3	consistent dependent system	A.REI.1	function notation	A.SSE.3	negative exponent	A.SSE.3	roots		
A.REI.3	consistent independent system	F.LE.2	geometric sequence	8.SP.1	no correlation	F.IF.7	scale		
F.IF.6	constant of variation	A.CED.2	graph ordered pairs	8.SP.1	nonlinear	8.SP.1	scatter plot		
A.REI.3	constant term	F.IF.8	growth factor	8.SP.1	nonlinear association	A.CED.3	set		
A.CED.3	constraints	F.IF.8	growth rate	F.IF.8	order of mag	F.IF.6	slope		
8.G.6	converse	S.ID.1	histogram	A.CED.2	ordered pair	F.IF.7	slope-intercept form		
A.CED.2	coordinate plane	8.G.6	hypotenuse	F.IF.7	origin	A.REI.3	solution		
S.ID.9	correlation	A.REI.5	identity	8.F.1	output	A.REI.5	solution to a system		
S.ID.8	correlation coefficient	A.REI.3	inconsistent system	8.SP.1	outlier	A.REI.5	solution to inequality		
N.RN.1	cube root	8.F.1	independent variable	F.IF.7	parabola	N.RN.1	square root		
A.REI.4	decay factor	A.CED.1	inequality	F.IF.8	parent function	A.REI.2	square root function		
A.APR.1	degree of polynomial	8.F.1	input	F.IF.8	parent quadratic function	S.ID.2	standard deviation		
8.F.1	dependent variable	N.RN.1	integer	N.RN.1	perfect square	A.REI.10	standard form		

Grade 8 Montana Common Core Vocabulary									
Standard	**Vocabulary**	**Standard**	**Vocabulary**	**Standard**	**Vocabulary**	**Standard**	**Vocabulary**	**Standard**	**Vocabulary**
A.CED.1	direct variation	N.RN.1	integer exponent	A.SSE.3	perfect square trinomial	F.LE.1	standard form of a quadratic function		
A.REI.4	discriminant	F.BF.1	interpolation	F.IF.4	periodicity	F.IF.7	step function		
A.REI.3	distributive property	S.ID.2	interquartile range	F.IF.7	piecewise function	8.SP.1	strong correlation		
F.IF.1	domain	8.EE.8	intersection	F.IF.7	point slope form	F.IF.4	symmetry		
S.ID.1	dot plot	F.BF.4	inverse function	A.APR.1	polynomials	A.REI.12	system of linear inequalities		
A.CED.3	element	A.REI.3	inverse operations	8.SP.1	positive association/correlation	8.EE.8	system of linear equations		
A.CED.3	empty set	N.RN.1	irrational number	F.LE.1	power	A.REI.3	term		
F.LE.1	equal intervals	A.SSE.2	leading coefficient	F.IF.8	properties of exponents	A.APR.1	trinomial		

GRADE 8 MATHEMATICS
ACCELERATED STRAND: ALGEBRA 1

Overview:

Domains	Seeing Structure in Expressions	Arithmetic with Polynomials and Rational Functions	Creating Equations	Reasoning with Equations and Inequalities
Clusters	• Interpret the structure of expressions • Write Expressions in equivalent forms to solve problems	• Perform arithmetic operations on polynomials • Understand the relationship between zeros and factors of polynomials • Use polynomial identities to solve problems • Rewrite rational expressions	• Create equations that describe numbers or relationships	• Understand solving equations as a process of reasoning and explain the reasoning • Solve equations and inequalities in one variable • Solve systems of equations • Represent and solve equations and inequalities graphically
Mathematical Practices	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively.	3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics.	5. Use appropriate tools strategically. 6. Attend to precision.	7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.
Major Thematic Grade 8 Units	<u>English Language Arts: across the content areas</u> • Reading • Writing • Speaking & Listening • Language • Figure it Out: Mysteries – What makes us want to read? • Science or Fiction – How do we determine where the line should be drawn between what we consider as fiction and what we explore as science? Does fiction fuel science or does science drive the writing of fiction? • The Road Not Taken: Going Against Conventional Wisdom – Does society always provide us with the best advice? How do we learn what to value and what choices to make? Can literature help us define the greater good?		<u>Science</u> • Structure of Matter • Properties of Matter • Basics of Energy • Forms of Energy • Forces and Motion • Simple Machines	<u>Social Studies</u> • Indigenous Cultures • Colonial Heritage • Events to the American Revolution • War for Independence • Constitution • New Nation • Age of Andrew Jackson • Regional Development • Industrial Beginnings • Pre-Civil War – Reconstruction

The fundamental purpose of this accelerated 8th Grade course is to formalize and extend the mathematics that students learned through the end of seventh grade. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions. In addition, the units will introduce methods for analyzing and using quadratic functions, including manipulating expressions for them, and solving quadratic equations. Students understand and apply the Pythagorean theorem, and use quadratic functions to model and solve problems. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations.

This course differs from High School Algebra 1 in that it contains content from 8th grade. While coherence is retained, in that it logically builds from the Accelerated 7th Grade, the additional content when compared to the high school course demands a faster pace for instruction and learning.

Critical Area 1: Work with quantities and rates, including simple linear expressions and equations forms the foundation for this unit. Students use units to represent problems algebraically and graphically, and to guide the solution of problems. Student experience with quantity provides a foundation for the study of expressions, equations, and functions. This unit builds on earlier experiences with equations by asking students to analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

Critical Area 2: Building on earlier work with linear relationships, students learn function notation and language for describing characteristics of functions, including the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. They work with functions given by graphs and tables, keeping in mind that depending upon the context, these representations are likely to be approximate and incomplete. Their work includes functions that can be described or approximated by formulas as well as those that cannot. When functions describe relationships between quantities arising from a context, students reason with the units in which those quantities are measured. Students explore systems of equations and inequalities, and they find and interpret their solutions. Students build on and informally extend their understanding of integral exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

Critical Area 3: Students use regression techniques to describe relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

Critical Area 4: In this unit, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

Critical Area 5: In preparation for work with quadratic relationships students explore distinctions between rational and irrational numbers. They consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a

quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students learn that when quadratic equations do not have real solutions the number system must be extended so that solutions exist, analogous to the way in which extending the whole numbers to the negative numbers allows x+1 = 0 to have a solution. Formal work with complex numbers comes in Algebra II. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined.

Domain: Expressions and Equations 8.EE

Cluster: Analyze and solve linear equations and pairs of simultaneous linear equations.

8. Analyze and solve pairs of simultaneous linear equations.
   a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
      - I can graph two linear equations on the same coordinate plane and identify their point of intersection if possible.
      - I can defend that the point of intersection of two lines on the same coordinate plane is a solution for both equations.
   b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.*
      - I can rewrite an equation from standard form into slope-intercept form.
      - I can solve a system of two linear equations algebraically.
      - I can estimate the solution of a system of linear equations by graphing.
   c. Solve real-world and mathematical problems from a variety of cultural contexts, including those of Montana American Indians, leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*
      - I can solve real-world mathematical problems from a variety of cultures which involve systems of linear equations.

Domain: Functions 8.F

Cluster: Define, evaluate, and compare functions.

1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.[1]
   ([1]Function notation is not required in Grade 8.)
      - I can define a function as a rule for ordered pairs that shows each input has exactly one output.
      - I can relate input to output in graphical form as ordered pairs.

2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*
      - I can create a function table.
      - I can graph the contents of a function table.

- I can write a function rule in y = m * x + b form from multiple sources.
- I can compare and analyze two functions represented in different forms.

3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*
   - I can identify the attributes of linear or non-linear functions based on multiple sources.

Cluster: Use functions to model relationships between quantities.

4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
   - I can determine the rate of change and initial value from a table, a graph, an equation, and a verbal model.
   - I can write a function rule (y = m * x + b) from any of the other three representations.

5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
   - I can write a verbal model of a graph showing a functional relationship.
   - I can produce an approximate graph of a functional relationship from a verbal model.

Domain: Geometry 8.G

Cluster: Understand and apply the Pythagorean Theorem.

6. Explain a proof of the Pythagorean Theorem and its converse.
   - I can explain and prove the Pythagorean Theorem and its converse.

7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. *For example, determine the unknown height of a Plains Indian tipi when given the side length and radius.*
   - I can apply the Pythagorean Theorem to determine unknown side lengths in 2D and 3D real world situations.

8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
   - I can apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Domain: Statistics and Probability 8.SP

Cluster: Investigate patterns of association in bivariate data.

1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

- I can define and create examples of clustering, outliers, positive or negative association, linear association, and nonlinear association.
- I can construct and interpret scatter plots to investigate patterns of association.

2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
   - I can sketch a line of best fit for a graph of bivariate data.(scatter plot)
   - I can construct and interpret scatter plots to investigate patterns of association.
   - I can use the closeness of the data points to the line of best fit to assess the correlation between the predicted values and the actual data.

3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*
   - I can interpret the slope and intercept of a line of best fit in the context of the bivariate data set.

4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data including data from Montana American Indian sources on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*
   - I can construct a two-way frequency table from a variety of cultural contexts, including data from Montana American Indian sources.
   - I can interpret relative frequencies calculated for rows or columns to describe possible associations between the two variables.

Number and Quantity Content Standards

Domain: The Real Number System N-RN

Cluster: Extend the properties of exponents to rational exponents.

1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.*
   - I can apply the properties of exponent to rational exponents.
   - I can explain how rational exponents follow from the properties of integer exponents. (See above)

2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.
   - I can write radical expressions using rational exponents and vice versa.

Cluster: Use properties of rational and irrational numbers.

3. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.
   - I can use the closure property or show by example the sum or product or two rational numbers are rational.
   - I can use the closure property or show by example the sum of a rational and an irrational number is irrational.
   - I can use the closure property or show by example the product or a nonzero rational number and an irrational is irrational.

Domain: Quantities N-Q

Cluster: Reason quantitatively and use units to solve problems.

1. Use units as a way to understand problems from a variety of contexts (e.g., science, history, and culture), including those of Montana American Indians, and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
   - I can interpret units in the context of the problem.
   - I can use unit analysis to check the reasonableness of my solution.
   - I can choose and interpret an appropriate scale given data to be represented on a graph or display.

2. Define appropriate quantities for the purpose of descriptive modeling.
   - I can determine an appropriate quantity to model a situation.

3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
   - I can choose a level of accuracy appropriate to the measuring tool or situation.

Algebra Content Standards

Domain: Seeing Structure in Expressions A-SSE

Cluster: Interpret the structure of expressions.

1. Interpret expressions that represent a quantity in terms of its context.
   a. Interpret parts of an expression, such as terms, factors, and coefficients.
      - I can interpret expressions that represent a quantity in terms of its context.
      - I can identify the different parts of an expression and explain their meaning within the context of a problem.
   b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.*
      - I can interpret expressions and make sense of the multiple factors and terms by explaining the meaning of the individual parts.

2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*
   - I can rewrite algebraic expressions in equivalent forms such as factored or simplified form.
   - I can use factoring techniques such as common factors, grouping, the difference of two squares, the sum or difference of two cubes, or a combination of methods to factor an expression completely.
   - I can simplify expressions by combining like terms, using the distributive property and using other operations with polynomials.

Cluster: Write expressions in equivalent forms to solve problems.

3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
   a. Factor a quadratic expression to reveal the zeros of the function it defines.
      - I can choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
      - I can write expressions in equivalent forms by factoring to find the zeros of a quadratic function and explain the meaning of the zeros.
   b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
      - I can complete the square in a quadratic expression to convey the vertex form and determine the maximum or minimum value of the quadratic function, and to explain the meaning of the vertex.
   c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*
      - I can use properties of exponents (such as power of a power, product of powers, power of a product, power of a quotient) to write an equivalent form of an exponential function to reveal and explain specific information about its approximate rate of growth or decay.

Domain: Arithmetic with Polynomials and Rational Expressions — A-APR

Cluster: Perform arithmetic operations on polynomials.

1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
   - I can identify polynomials.
   - I can add, subtract, and multiply polynomials.
   - I can recognize how closure applies under these operations.

Domain: Creating Equations — A-CED

Cluster: Create equations that describe numbers or relationships.

1. Create equations and inequalities in one variable and use them to solve problems from a variety of contexts (e.g., science, history, and culture), including those of Montana American Indians. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

- I can create linear, quadratic, rational and exponential equations and inequalities in one variable and use them in a contextual situation to solve problems.

2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
   - I can create equations in two or more variables to represent relationships between quantities.
   - I can graph equations in two variables on a coordinate plane and label the axes and scales.

3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*
   - I can write and use a system of equations and/or inequalities to solve a real world problem.
   - I can use equations and inequalities to represent problem constraints and objectives (linear programming).

4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*
   - I can solve multi-variable formulas or literal equations for a specific variable.

Domain: Reasoning with Equations and Inequalities A-REI

Cluster: Understand solving equations as a process of reasoning and explain reasoning.

1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
   - I can construct a convincing argument that justifies each step in the solution process assuming an equation has a solution.

Cluster: Solve equations and inequalities in one variable.

3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
   - I can solve linear equations in one variable, including equations with coefficients represented by letters.
   - I can solve linear inequalities in one variable, including inequalities with coefficients represented by letters.

4. Solve quadratic equations in one variable.
   a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)2 = q$ that has the same solutions. Drive the quadratic formula from this form.
   - I can solve quadratic equations in one variable.
   - I can transform a quadratic equation to an equation in the form $(x - p2 = q$ by completing the square.
   - I can drive the quadratic formula by completing the square on a quadratic equation.

b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

- I can solve quadratic equations in one variable by simple inspection, taking the square root, factoring, and completing the square.
- I can explain why taking the square root of both sides of an equation can yield two solutions.
- I can use the quadratic formula to solve quadratic equation, recognizing the formula produces all complex solutions and write the solutions in the form $a \pm bi$ where a and b are real numbers.

Cluster: Solve systems of equations.

5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
   - I can produce, with justification, from a system of two equations an equivalent simpler system.

6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
   - I can solve systems of equations using substitution, linear combination, and graphing.

7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.
   - I can solve a system containing a linear equation and a quadratic equation in two variables algebraically and graphically.

Cluster: Represent and solve equations and inequalities graphically.

10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
    - I can find any solution to an equation in two variables from the graph of that equation.

11. Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear and exponential.
    - I can explain why the intersection of $y = f(x)$ and $y = g(x)$ is the solution of $f(x) = g(x)$ for any combination of linear, polynomial, rational, absolute value, exponential, and logarithmic functions.
    - I can use technology to graph the equations and find their points of intersection.
    - I can use tables of values or successive approximations to find solutions.

12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

- I can graph the solutions to a linear inequality in two variables as a half-plane, excluding the boundary for strict inequalities.

Functions Content Standards

Domain: Interpreting Functions F-IF

Cluster: Understand the concept of a function and use function notation.

1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).
   - I can use the definition of a function to determine whether a relationship is a function given a table, graph or words.
   - I can identify x as an element of the domain and *f(x)* as an element in the range given the function *f*.
   - I can identify that the graph of the function f is the graph of the function *y=f(x)*.

2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
   - I can use function notation, *f(x)*, when a relation is determined to be a function.
   - I can evaluate functions for inputs in their domains.
   - I can interpret statements that use function notation in terms of a context in which they are used.

3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
   - I can recognize that arithmetic and geometric sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
   - I can write a recursive formula in function notation for a generated sequence.

Cluster: Interpret functions that arise in applications in terms of the context.

4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*⋆
   - I can identify key features in graphs and tables to include intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior for a linear, exponential and quadratic function.
   - I can sketch the graph of a function given its key features.

5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*⋆

- I can interpret a graph to determine the appropriate numerical domain being described in the linear, exponential and quadratic functions.

6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.⋆
   - I can calculate and interpret the average rate of change of a function presented symbolically or as a table.
   - I can estimate the average rate of change over a specified interval of a function from its graph.

Cluster: Analyze functions using different representations.

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.⋆
   a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
      - I can graph linear functions showing intercepts.
      - I can graph quadratic functions showing intercepts, a maximum or a minimum.
   b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
      - I can graph square root, cube root and piecewise-defined functions, including step functions and absolute value functions.
   e. Graph exponential showing intercepts.
      - I can graph exponential functions, showing intercepts and end behavior.

8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
   a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
      - I can use the process of factoring and completing the square in a quadratic function to show zeros, a maximum or minimum, and symmetry of the graph, and interpret these in terms of a real-world situation.
      - I can explain different properties of a function that are revealed by writing a function in equivalent forms.
   b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.
      - I can use the properties of exponents to interpret exponential functions as growth or decay.
      - I can identify the percent rate of change in an exponential function.

9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
   - I can compare the key features of two linear, exponential, quadratic, absolute value, step and piecewise defined functions that are represented in different ways.

Cluster: Build a function that models a relationship between two quantities.

1. Write a function that describes a relationship between two quantities.⋆
   a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
      - I can write an explicit or recursive expression or describe the calculations needed to model a function given a situation.
      - I can write a linear, quadratic or exponential function that describes a relationship between two quantities.
   b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
      - I can combine function types, such as linear and exponential, using arithmetic operations.

2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations from a variety of contexts (e.g., science, history, and culture, including those of the Montana American Indian), and translate between the two forms.⋆
   - I can make connections between linear functions and arithmetic sequences, and exponential functions and geometric sequences.
   - I can write and translate between the recursive and explicit formula for a arithmetic sequence and use the formulas to model a situation.
   - I can write and translate between the recursive and explicit formula for a geometric sequence and use the formulas to model a situation

Cluster: Build new functions from existing functions.

3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
   - I can experiment to identify, using technology, the transformational effects on the graph of a function *f(x)* (*linear, exponential, quadratic or absolute value functions*) when *f(x)* is replaced by *f(x)+k*, *k·f(x)*, *f(kx)*, and *f(x+k)* for specific values of k, both positive and negative.
   - I can find the value of k given the graph of a transformed function.
   - I can recognize even and odd functions from their graphs and equations.

4. Find inverse functions.
   a. Solve an equation of the form $f(x) = ax + b$ for a simple function f that has an inverse and write an expression for the inverse. *For linear functions only.*
      - I can solve a linear function for the dependent variable and write the inverse of a linear function by interchanging the dependent and independent variables.

Cluster: Construct and compare linear, quadratic, and exponential models and solve problems.

1. Distinguish between situations that can be modeled with linear functions and with exponential functions.
   a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
      - I can determine a situation as linear or exponential by examining rates of change between data points.
      - I can show there is a constant difference in a linear function over equal intervals.
      - I can show there is a constant ratio in an exponential function over equal intervals.
   b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
      - I can describe situations where one quantity grows or decays by a constant ratio per unit interval relative to another.
   c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
      - I can describe situations where one quantity changes at a constant rate per unit interval relative to another.

2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
   - I can write a linear or exponential function given an arithmetic or geometric sequence, a graph, a description of the relationship, or two points which can be read from a table.

3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
   - I can use graphs and tables to make the connection that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or any other polynomial function.

Cluster: Interpret expressions for functions in terms of the situation they model.

5. Interpret the parameters in a linear or exponential function in terms of a context.
   - I can explain the meaning of the coefficients, constants, factors, exponents, and intercepts in a linear or exponential function in terms of a context.

Modeling Content Standards

Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Quantities and their relationships in physical, economic, public policy, social, and everyday situations can be modeled using mathematical and statistical methods. When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data.

Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards.

Statistics and Probability Content Standards

Domain: Interpreting Categorical and Quantitative Data S-ID

Cluster: Summarize, represent, and interpret data on a single count or measurement variable.

1. Represent data with plots on the real number line (dot plots, histograms, and box plots).
   - I can construct dot plots, histograms and box plots on a real number line.

2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
   - I can describe a distribution using center and spread.
   - I can use the correct measure of center and spread to describe a distribution that is symmetric or skewed.
   - I can compare two or more different data sets using the center and spread of each.

3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
   - I can identify outliers (extreme data points) using IQR and their effects on data sets.
   - I can interpret differences in different data sets in context.
   - I can interpret differences due to possible effects of outliers.

Cluster: Summarize, represent, and interpret data on two categorical and quantitative variables.

5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
   - I can create a two-way table from two categorical variables and read values from a two-way table
   - I can interpret joint, marginal, and relative frequencies in context.
   - I can recognize associations and trends in data from a two-way table.

6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
   a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear models. Discuss general principles referring to quadratic, and exponential models.
   - I can create a scatter plot from two quantitative variables.
   - I can describe the form (linear, quadratic or exponential), strength (strong to weak) and
     1. direction (positive or negative) of the relationship.
   - I can explain the meaning of slope and y-intercept (linear model) or the meaning of the growth rate and y-intercept (exponential model) or the meaning of the coefficients (quadratic model) in context.

- I can use algebraic methods or technology to fit the data to a linear, exponential or quadratic function.

b. Informally assess the fit of a function by plotting and analyzing residuals.
- I can calculate a residual.
- I can create and analyze a residual plot.

c. Fit a linear function for a scatter plot that suggests a linear association.
- I can use algebraic methods or technology to fit the data to a linear function.
- I can use the function to predict values.

Cluster: Interpret linear models.

7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
   - I can explain the meaning of the slope and y-intercept in context.

8. Compute (using technology) and interpret the correlation coefficient of a linear fit.
   - I can use a calculator or computer to find the correlation coefficient for a linear association.
   - I can interpret the meaning of the correlation coefficient in the context of the data.

9. Distinguish between correlation and causation.
   - I can explain the difference between correlation and causation.

Standards	Explanations and Examples
Students are expected to:	The Standards for Mathematical Practice describe ways in which students ought to engage with the subject matter as they grow in mathematical maturity and expertise.
8.MP.1. Make sense of problems and persevere in solving them.	In grade 8, students solve real world problems through the application of algebraic and geometric concepts. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?"
8.MP.2. Reason abstractly and quantitatively.	In grade 8, students represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. They examine patterns in data and assess the degree of linearity of functions. Students contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.
8.MP.3. Construct viable arguments and critique the reasoning of others.	In grade 8, students construct arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, and graphs, tables, and other data displays (i.e. box plots, dot plots, histograms, etc.). They further refine their mathematical communication skills through mathematical discussions in which they critically evaluate their own thinking and the thinking of other students. They pose questions like "How did you get that?", "Why is that true?" "Does that always work?" They explain their thinking to others and respond to others' thinking.
8.MP.4. Model with mathematics.	In grade 8, students model problem situations symbolically, graphically, tabularly, and contextually. Students form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. Students solve systems of linear equations and compare properties of functions provided in different forms. Students use scatterplots to represent data and describe associations between variables. Students need many opportunities to connect and explain the connections between the different representations. They should be able to use all of these representations as appropriate to a problem context.
8.MP.5. Use appropriate tools strategically.	Students consider available tools (including estimation and technology) when solving a mathematical problem and decide when certain tools might be helpful. For instance, students in grade 8 may translate a set of data given in tabular form to a graphical representation to compare it to another data set. Students might draw pictures, use applets, or write equations to show the relationships between the angles created by a transversal.
8.MP.6. Attend to precision.	In grade 8, students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students use appropriate terminology when referring to the number system, functions, geometric figures, and data displays.
8.MP.7. Look for and make use of structure.	Students routinely seek patterns or structures to model and solve problems. In grade 8, students apply properties to generate equivalent expressions and solve equations. Students examine patterns in tables and graphs to generate equations and describe relationships. Additionally, students experimentally verify the effects of transformations and describe them in terms of congruence and similarity.
8.MP.8. Look for and express regularity in repeated reasoning.	In grade 8, students use repeated reasoning to understand algorithms and make generalizations about patterns. Students use iterative processes to determine more precise rational approximations for irrational numbers. During multiple opportunities to solve and model problems, they notice that the slope of a line and rate of change are the same value. Students flexibly make connections between covariance, rates, and representations showing the relationships between quantities.

Grade 8 Accelerated Montana Common Core Vocabulary									
Standard	Vocabulary	Standard	Vocabulary	Standard	Vocabulary	Standard	Vocabulary	Standard	Vocabulary
S.ID.2	absolute deviation	A.REI.3	equation	8.G.6	leg	8.G.6	Pythagorean Theorem	S.ID.5	two way table
F.IF.7	absolute value	A.CED.4	equivalent equation	A.REI.3	like terms	F.LE.1	quadratic equation	A.CED.3	union
F.IF.7	absolute value equation	A.CED.4	equivalent expression	8.SP.2	line of best fit/trend line	A.CED.1	quadratic formula	F.LE.1	unit rate
F.IF.7	absolute value function	A.REI.5	equivalent inequalities	A.REI.3	linear	F.LE.1	quadratic function	8.SP.4	univariate
A.RIE.3	additive identity	F.LE.1	exponent	8.SP.1	linear association	A.REI.2	radical	A.CED.3	universal set
A.REI.3	additive inverse	A.CED.1	exponential	A.CED.1	linear equation	A.REI.2	radical expression	A.CED.1	variable
F.LE.2	arithmetic sequence	F.IF.8	exponential decay	A.CED.2	linear function	A.REI.2	radical function	F.LE.1	vertex
F.IF.7	axis of symmetry	F.LE.1	exponential function	A.CED.1	linear inequality	A.REI.2	radical symbol	F.LE.1	vertex form of a quadratic equation
A.CED.1	base	F.IF.8	exponential growth	F.IF.7	linear model	F.IF.1	range	F.LE.3	vertical motion model
A.REI.4	binomial	A.SSE.1	expression	F.IF.8	linear regression	F.IF.6	rate	A.REI.1	x and y intercepts
8.SP. 4	bivariate	A.REI.2	extraneous solution	F.IF.7	linear representation	F.IF.6	rate of change	A.SSE.3	zero exponent
S.ID.1	box and whisker plot	F.BF.1	extrapolation	A.CED.4	literal equation	F.IF.6	ratio	A.SSE.3	zeros of a function
S.ID.9	causation	S.ID.3	extreme value	A.SSE.3	maximum value/maxima	N.RN.1	rational equation		
A.REI.2	closed system	A.SSE.1	factor	S.ID.3	measures of central tendency	N.RN.1	rational number		
8.SP.1	clustering	A.SSE.3	factor completely	A.SSE.3	minimum value/minima	N.RN.3	real number		
A.SSE.1	coefficient	A.REI.4	factoring	A.APR.1	monomial	A.REI.3	reciprocal		
A.REI.4	completing the square	F.IF.8	family of function	A.REI.3	multiplicative identity	F.BF.1	recursive		
A.CED.3	compound inequality	S.ID.5	frequency	A.REI.3	multiplicative inverse	A.CED.1	relation		
A.REI.4	compound interest	A.CED.1	function	8.SP.1	negative association/correlation	A.REI.2	restricted domain		
A.REI.3	consistent dependent system	A.REI.1	function notation	A.SSE.3	negative exponent	A.SSE.3	roots		
A.REI.3	consistent independent system	F.LE.2	geometric sequence	8.SP.1	no correlation	F.IF.7	scale		
F.IF.6	constant of variation	A.CED.2	graph ordered pairs	8.SP.1	nonlinear	8.SP.1	scatter plot		
A.REI.3	constant term	F.IF.8	growth factor	8.SP.1	nonlinear association	A.CED.3	set		
A.CED.3	constraints	F.IF.8	growth rate	F.IF.8	order of mag	F.IF.6	slope		
8.G.6	converse	S.ID.1	histogram	A.CED.2	ordered pair	F.IF.7	slope-intercept form		
A.CED.2	coordinate plane	8.G.6	hypotenuse	F.IF.7	origin	A.REI.3	solution		
S.ID.9	correlation	A.REI.5	identity	8.F.1	output	A.REI.5	solution to a system		
S.ID.8	correlation coefficient	A.REI.3	inconsistent system	8.SP.1	outlier	A.REI.5	solution to inequality		
N.RN.1	cube root	8.F.1	independent variable	F.IF.7	parabola	N.RN.1	square root		
A.REI.4	decay factor	A.CED.1	inequality	F.IF.8	parent function	A.REI.2	square root function		
A.APR.1	degree of polynomial	8.F.1	input	F.IF.8	parent quadratic function	S.ID.2	standard deviation		
8.F.1	dependent variable	N.RN.1	integer	N.RN.1	perfect square	A.REI.10	standard form		
A.CED.1	direct variation	N.RN.1	integer exponent	A.SSE.3	perfect square trinomial	F.LE.1	standard form of a quadratic function		

Grade 8 Accelerated Montana Common Core Vocabulary									
Standard	**Vocabulary**	**Standard**	**Vocabulary**	**Standard**	**Vocabulary**	**Standard**	**Vocabulary**	**Standard**	**Vocabulary**
A.REI.4	discriminant	F.BF.1	interpolation	F.IF.4	periodicity	F.IF.7	step function		
A.REI.3	distributive property	S.ID.2	interquartile range	F.IF.7	piecewise function	8.SP.1	strong correlation		
F.IF.1	domain	8.EE.8	intersection	F.IF.7	point slope form	F.IF.4	symmetry		
S.ID.1	dot plot	F.BF.4	inverse function	A.APR.1	polynomials	A.REI.12	system of linear inequalities		
A.CED.3	element	A.REI.3	inverse operations	8.SP.1	positive association/correlation	8.EE.8	system of linear equations		
A.CED.3	empty set	N.RN.1	irrational number	F.LE.1	power	A.REI.3	term		
F.LE.1	equal intervals	A.SSE.2	leading coefficient	F.IF.8	properties of exponents	A.APR.1	trinomial		